(18.)

A COLLECTION OF TURBELLARIA POLYCLADIDA FROM THE STRAITS OF MALACCA. (SKEAT EXPEDITION, 1899—1900.)

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On a Collection of Turbellaria Polycladida from the Straits of Malacca. (Skeat Expedition, 1899–1900.)

By F. F. LAIDLAW, B.A. Cantab., Assistant Lecturer and Demonstrator in the Owens College.[1]

[2] (Plate XXIII. & Text-figures 50–56.)

The collection described below was made entirely by Mr. Evans on the shores of a small islet called Pulau Bidan, a few miles north of Penang. It proves a most interesting one, and includes, so far as I can discover, only one previously known species, *Thysanozoon auropunctatum* Coll.

As in describing Mr. Gardiner's collection from the Maldives [4], I have to note the scarcity or absence of the Euryleptidæ, represented doubtfully only by a much damaged fragment in Mr. Evans's series.

The only previous record of species from the shores of the Malay Peninsula that I have been able to discover was made by Collingwood, who described and figured the following species from Singapore :—

Thysanozoon allmani.
Proceros hancockianus.
,, *buskii.*
Sphyngiceps lacteus.
Eurylepta kelaartii.
Elasmodes obtusum.
Leptoplana aurantiaca.

Grouping these specimens with those of the Skeat Collection and adding *Pseudoceros bedfordii* from Singapore, kindly given me by Mr. Lanchester, we get the following list classified according to Lang's system [6] :—

Acotylea.
PLANOCERIDÆ.
* *Planocera* sp.
1.* *Notoplana evansii*, sp. n.

[1] Communicated by Dr. S. F. HARMER, F.Z.S.
[2] For explanation of the Plate, see p. 318.

Acotylea (*con.*).

Leptoplanidæ.

2.* *Semonia penangensis*, sp. n.
3.* *Leptoplana malayana*, sp. n.
4. ,, *obtusum* (Coll.).

Cryptocelididæ.

5.* *Bergendalia anomala*.

Latocestidæ.

6.* *Latocestus argus*.

Cotylea.

Pseudoceridæ.

7. *Thysanozoon allmani*.
8.* ,, *auropunctatum*.
9. *Pseudoceros hancockianus* (Coll.).
10. ,, *buskii* (Coll.).
11. ,, *kelaartii* (Coll.).
12. ,, *bedfordii*, sp. n.
13.* ,, *collingwoodii*, sp. n.
14.* *Pseudoceros ? rubellus*, sp. n.

Diposthidæ.

15.* *Asthenoceros woodworthi*, sp. n.

Prosthiostomidæ.

16.* *Prosthiostomum pallidum*, sp. n.
17. ,, *aurantiacum* (Coll.).

Species marked with an asterisk were collected by Mr. Evans.

In this communication I have not ventured to give an account of the anatomy of any of the species, contained in the collection, which can be regarded as being at all complete. Such an account would have expanded the paper beyond limits reasonable in a systematic description. I have attempted only to give such a diagnosis of each species as shall render its future identification a matter of tolerable certainty, and to call attention to any of the more striking features which presented themselves.

Family Planoceridæ.

Planocera sp. (Plate XXIII. fig. 1.)

A fragment of tissue of which I made microscopic sections proves to belong to a species of this genus, but being only a fragment I will not attempt to describe or name it, though it is obviously new. The section passes through the penis and prostate, and the spines lining the lumen of the former are of such a remarkable character that I venture to figure one of them, in the hope that a perfect example may be obtained ere long. The length of each spine is roughly ·08 mm., its breadth at the base ·02 mm.

Notoplana, gen. nov.

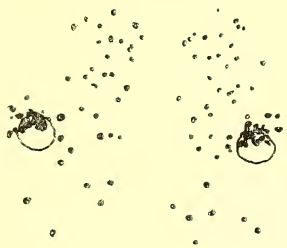
Notoplana evansii, sp. n. (Plate XXIII. fig. 2.)

A number of specimens belonging to this species were taken by

Mr. Evans on the shores of the island of Pulau Bidan, where it is evidently one of the commoner species.

The body of this worm is rather elongated, rounded in front and with a pointed hinder extremity. The arrangement of its eye-spots is shown in the accompanying figure (text-fig. 50).

Text-fig. 50.



Eye-spots of *Notoplana evansii*.

Unfortunately I have no notes as to colour, but, judging from the spirit-specimens, the creature is probably of a yellowish-grey colour, with a small number of irregularly scattered black spots. The gut-branches are numerous, and there is no anastomosis.

The dimensions of an average individual are as follows:—

Length	25	mm.
Breadth	15	,,
Tentacles from ant. margin	5	,,
Mouth-opening ,,	12	,,
♂. Aperture behind mouth	3·5	,,
♀. ,, behind male	1·5	,,

Genital Apparatus (see text-fig. 51, 304).

The most striking features of the male copulatory apparatus are the great length of the antral chamber and the chambered prostate organ, the latter recalling the prostate of certain Leptoplanas, e. g. *L. alcinoi*. From the male aperture the antral cavity (text-fig. 51, *a.m.*) extends forwards as far as the level of the hinder end of the pharynx. It has very muscular walls and runs sloping in an upward direction. Lang, in his diagram of the genital apparatus of *Hoploplana* (*Planocera insignis* group [6]), calls this chamber the penis-sheath ("Penisscheide), but this term should, I think, be reserved for the sheath-like folds of the walls of the antral chamber occurring in *Cestoplana* and in certain Cotylean genera.

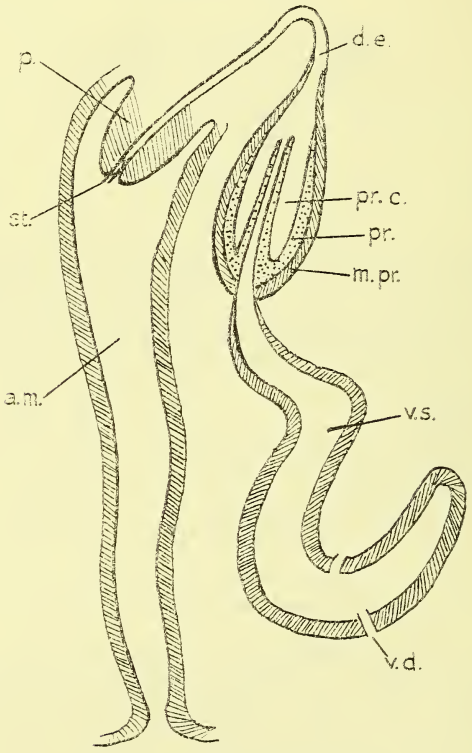
The lining of the walls of the antral chamber in the present species consists of a flattened ciliated (?) epithelium; the muscular wall consists of a thick layer of interlacing circular fibres.

The penis (*p.*) itself is small and projects into the antral chamber at the upper anterior end of the latter.

The penis is a fleshy organ, composed of longitudinal and circular fibres which exhibit numerous nuclei (see Plate XXIII. fig. 2). It is armed with a chitinous stylet.

The base of the penis is entered by the short ductus ejaculatorius (*d.e.*) which leads to the prostate region. It turns shortly after leaving the penis and runs in a backward direction, so that a

Text-fig. 51.



Male organs of *Notoplana evansii*.

For explanation of lettering, see p. 318.

transverse section passing through the penis passed also through the prostate (see Pl. XXIII. fig. 2 and also text-fig. 51).

The prostate consists of a number, some nine in all, of small chambers (*pr.c.*) which lie about the ductus ejaculatorius and open into it at their distal ends. The ductus, elsewhere with muscular walls, here is lined only with a very flattened epithelium, outside which lies a second layer of similar cells belonging to the

inner walls of the prostate chambers. Between each of these chambers a fine double septum runs out from this inner wall (Plate XXIII. fig. 2, *s.*). The prostate cells stain very feebly, and the lumen of each chamber is well defined, and contains in most cases a certain amount of secreted matter. Outside the chambers is a fairly thick layer of circular muscle-fibres, and, beyond these, an ill-defined layer of cells which appear to be glandular. Here and there are faint indications of processes from these outer glandular cells, piercing the muscle-layer of the prostate organ. This muscle-layer is also traversed by processes from the septa of the chambers. There is no longitudinal muscle-coat to the prostate.

Towards the level where the prostate-chambers open into the ductus ejaculatorius, some of them open into each other, so that the number of chambers seen in cross-section is reduced to four or five.

On the proximal, hinder, side of the prostate, the ductus is continued back into the vesicula seminalis (*v.s.*), which is long and contorted. It is lined with a ciliated epithelium, and its walls are composed of regularly arranged circular muscle-fibres. At its extreme hinder end it turns sharply forward and ends blindly. Just before it takes this turn forward, the two vasa deferentia open into it, one on either side, after piercing through its muscular wall.

There is a spacious antrum femininum surrounded by the large shell-glands, the secretions of which it receives. The vagina leaves the antrum dorsally, and runs forward for the first part of its course through the shell-glands, the secretion of which it also receives. It then turns first dorsalwards and then backwards, acquiring in its course a fine wall of circular muscle-fibres. After running back for a short distance, it receives the short common duct from the two uteri. It then continues to run back as far as the level of the antrum femininum, where it ends blindly.

It is evident that this species is closely allied to von Plehn's *Plagiotata promiscua* [7]; in fact, the terminal parts of the male apparatus in the two species have almost identically the same structure.

It differs from von Plehn's species in having the pharynx of the normal type, not elongated transversely. This character is of sufficient importance to justify the placing of these species in two separate genera. In addition *Notoplana* is characterised by differences in the female apparatus, and by the great length of the antral chamber of the male organ.

The genus *Notoplana* may be defined, then, as follows:—

A Planoceroid genus with styliform penis and without a bursa copulatrix. The male antral chamber is very long; there is a complicated prostatic organ consisting of several chambers lying around the ductus ejaculatorius in front of the vesicula seminalis. The latter is long and twisted. Body rather elongate, without marginal eyes; mouth-opening rather behind the middle; pharynx normal; gut-branches numerous, without anastomosis.

Family Leptoplanidæ.

Leptoplana malayana, sp. n. (Plate XXIII. fig. 3.)

A number of specimens; some, preserved in formol, are of a uniform greyish-brown.

Length, about.....	35	mm.	
Eyes, about	8	,,	from the anterior end.
Mouth-opening, about	15	,,	,, ,,
♂ aperture, about ...	10	,,	from the hinder end.
♀ ,, ,, ...	1	,,	from male.

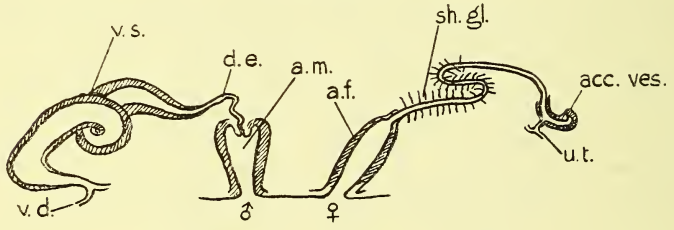
The arrangement of the eye-spots is that usual in the genus: there are two small clusters of "tentacle-eyes" about 1·5 mm. apart, and in front of these are a few scattered spots on either side of the middle line.

This species is closely allied to *L. pacificola* von Plehn [7].

Genital Apparatus (see text-fig. 52).

The vasa deferentia (*v.d.*) open into the proximal (anterior) end of the vesicula seminalis (*v.s.*); the latter, of considerable length and much twisted, is lined with ciliated epithelium, and has thick

Text-fig. 52.



Genital apparatus of *Leptoplana malayana*.
a.f., antrum femininum; *acc.ves.*, accessory vesicle; *sh.gl.*, shell-glands; *u.t.*, uterine duct; *v.d.*, vasa deferentia. For other letters see p. 318.

muscular walls made up of circular fibres. At its distal end the vesicula narrows into the ductus ejaculatorius (*d.e.*), which is shorter, but, like the vesicula, much twisted. Its walls are like those of the vesicula, but it is much narrower and has a less well-developed muscle-layer. The penis is small, fleshy, and unarmed, and projects into the large antral chamber, which has thick muscular walls and extends vertically upwards almost to the level of the dorsal body-wall muscles. (See Plate XXIII. fig. 3.)

The female opening lies close behind the male, and leads into a moderately large antral chamber (*a.f.*) with muscular walls. Into this the vagina opens from above. This latter organ is a long and tortuous duct of varying diameter; the shell-glands (*sh.gl.*) open into it through nearly its whole length. At its hinder end, near

the point where the uteri open into it, the muscular walls, which are elsewhere feebly developed along its course, become thicker, but not very markedly so (cf. *L. californica* von Plehn). The two uteri (*ut.*) unite as they enter it from below, and behind them there is a very small accessory vesicle (*acc.ves.*) with muscular walls.

The genus *Leptoplana*, as at present constituted, contains a considerable number of species, many of them only referred by Lang with doubt to the genus. In the majority of the species, the anatomy of which has been investigated by means of serial sections, the genital apparatus presents the following characters :—

The penis is directed backwards. The vasa deferentia open into a muscular vesicula seminalis ; from this the ductus ejaculatorius runs backwards to open into a prostate organ, which may be chambered ; leaving this, the duct runs back into the penis, which may be armed with a chitinous stylet.

The vagina runs back from the antrum femininum, receives the secretion of the shell-glands, and further back the two uteri open into it ventrally, usually by a common duct. An accessory vesicle is generally present. The most familiar species of the genus, *L. tremellaris*, differs from the majority of species in the structure of its male apparatus sufficiently to permit us to put it on one side to form of itself a section of the genus further characterised by the possession of a ventral sucker between the genital openings. Another species, *L. subviridis* von Plehn [8] (=*L. pardalis* mihi [4]), approaches *Discocelis tigrina* in the structure of its female organs, and accordingly we may put this species also in a section apart.

The remaining species I have attempted to classify below, so far as is at present possible, according to the structure of the penis and prostate. I trust that I will not be thought to have laid too much stress on the structure of these organs in dealing with this or other genera. It seems to me that, of all the characters that present themselves for classifying this order of Turbellaria, these are the most useful, and that they are as reliable as any of the other characters employed for this purpose, such as structure of the pharynx, number and arrangement of eye-spots, presence or absence of tentacles, &c. &c.

I propose, then, to group the species in two sections, A, and B, so far as our knowledge of their anatomy permits :—

A. Penis provided with a stylet.

(a) Prostate complicated by radially arranged "Drusenkanäle."

1. *L. kukenthali* v. Plehn. Spitzbergen [7].

(b) Prostate divided into chambers lying parallel to the ductus ejaculatorius.

2. *L. vitrea* Lang. Mediterranean [6].
3. *L. alcinoi* Schmidt. „ [6].

(*c*) Prostate not chambered.

4. *L. panamensis* v. Plehn. Gulf of Panama [7].
5. *L. californica* v. Plehn. California, Chatham Is. [11]
6. *L. nationalis* v. Plehn. Ascension Is. [8].

The following also belong to section A, but their position in the section cannot be determined without information as to the prostate characters.

L. variabilis Giard.
L. ellipsoides Verrill.
L. virilis Verrill. } New England [13].
L. dræbachensis Oersted. Norway [6].

L. fallax (de Quatrefages) [6] should perhaps form a separate section of the genus on account of the great length of its stylet. It occurs on the south side of the English Channel.

B. Penis unarmed.

a. Prostate chambered.

7. *L. chierchæ* von Plehn. Callao [7].

β. Prostate not chambered.

8. *L. pallida* (de Quatrefages). Mediterranean [6].
9. *sp.* (unnamed). Maldives [4].

γ. No definite prostate.

10. *L. pacificola* von Plehn. Valparaiso [7].
11. *L. malayana*, sp. n. Straits of Malacca.

Belonging to this section but of uncertain position in it is *L. angusta* Verrill [13] from New England. *L. lacteoalba* Verrill [14] is insufficiently characterised, but said to be like *L. pallida*.

Semonia penangensis, sp. n.

Two specimens from Pulau Bidan. No note available as to colour. This interesting species agrees fairly closely with the only other species of the genus at present known, viz., *S. maculata* von Plehn, from Java [7]. It is, however, readily distinguished from that species by its external characters, the arrangement of the eye-spots being obviously very different and showing some approximation to the condition found in *Discocelis tigrina* (see text-fig. 53, p. 309).

The dimensions of the larger specimen are as follows:—

Total length, about	22	mm.	
Breadth, about	11	,,	
Mouth-opening, about ...	9	,,	from the hind end.
Genital aperture	1	,,	behind mouth-opening.
Brain, about	4	,,	from the anterior margin.

The marginal eyes extend back for about 8 mm. on either side. The arrangement of the brain and tentacle-eyes is shown in text-fig. 53, p. 309.

An important distinction between this species and *Semonia maculata* is afforded by the fact that in the latter the testes and

ovaries lie on the dorsal side of the body (see von Plehn [7]), whilst in the present species the position of the testes is normal. *i. e.* on the ventral side.

In one or two respects this species approaches the closely allied *Discocelis tigrina*, and is perhaps intermediate between that species and *S. maculata*. But the latter species is also certainly closely allied to *Discocelis*, and I am rather surprised to find that von Plehn has not instituted any comparison between the two genera. *S. penangensis* differs from *S. maculata*, and approaches *Discocelis tigrina*, not only in the features already mentioned, viz., the arrangement of the eye-spots and the position of the testes, but also in that the uteri unite to enter the vagina by a short common duct, and in having a very blunt, almost square penis.

Text-fig. 53.



"Brain-eyes" of *Semonia penangensis*.

It differs from *Discocelis*, and resembles *S. maculata*, in being without the characteristic large prostatic cells which occur in the epithelium of the penis and of the antrum, and without the remarkable paired structures which run forward from the accessory vesicle of *Discocelis tigrina*. Further, like *S. maculata*, it possesses a definite vesicula seminalis, which appears to be absent in *Discocelis*.

Lastly, *S. penangensis* is without the curious glandular vesicles found along the anterior ends of the vasa deferentia in *S. maculata*; and the vagina is prolonged, beyond the point where it receives the openings of the uteri, into a very small accessory vesicle—so small, in fact, that it almost escaped observation. This may be due to the fact that the only specimen available for section-cutting was not quite mature; or more probably, since the uteri were full of apparently ripe eggs, that this organ is undergoing degeneration.

It is obvious that the distinction between *Discocelis* and *Semonia* is a very slender one, but still, I think, sufficient to warrant the retention of the latter as a valid genus. The most important characters separating the two genera are the absence of a vesicula seminalis in *Discocelis*, and the curious horseshoe shape of the accessory vesicle in that genus.

Family Cryptocelididæ.

Bergendalia anomala, gen. et sp. nov. (Plate XXIII. figs. 4, 5, 6, & 8.)

A most remarkable and interesting form, probably allied to the anomalous genera *Cryptocelides* and *Polypostia*, described by Bergendal [1], and provisionally referred to the same family with them.

The structure of the female terminal ducts is, so far as I know, unique, and approached only by the species referred to *Trigonoporus* and *Polyporus* (see von Plehn [11]).

Only a single specimen was obtained. It is rather a large form, with a total length of about 60 mm. and breadth about 27 mm. The mouth-opening is some 15 mm. from the hind end, and the genital pores lie halfway between these two points.

The margin of the body is complete, surrounded by a continuous rather dense row of eye-spots. There are none of these, apparently, over the brain.

Colour in the spirit-specimen uniformly greyish white (see Pl. XXIII. fig. 8). The specimen appears to be in an early stage of sexual maturity, since no trace of ovaries or testes can be discovered.

The pharynx is large and much folded, the gut-branches are numerous and anastomose freely.

The cells of the epidermis are elongated, especially on the dorsal surface. True rhabdites are absent, but in place of them the epidermal cells are crowded with pseudorhabdites which are of a coarsely granular texture, faintly stained and columnar in shape. In my sections (stained with Grenacher's hæmatoxylin) certain gland-cells lying within the muscle-layers of the body-wall, especially on the ventral side, are deeply stained; from these cells run processes which pierce the muscle-layers and basement-membrane, and make their way to the surface through the epidermal cells. These deeply-lying gland-cells and their processes have rather a spongy appearance, due to their preservation not being quite perfect.

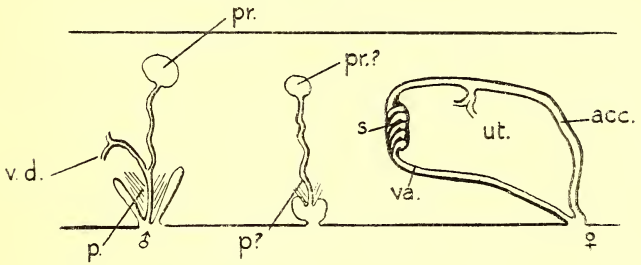
Genital Organs (text-fig. 54, p. 311).

The penis (*p.*) is a small fleshy organ composed of nucleated longitudinal fibres (Pl. XXIII. fig. 4). Its outer side is lined with cells continuous with those lining the antrum masculinum, but whereas the latter are ciliated, those covering the penis are non-ciliated. The base of the penis is pierced by a duct running nearly vertically upwards. Immediately after leaving the penis this is joined by two small ducts—the vasa deferentia (*v.d.*)—which run forward on either side of the middle line. In one of them, at the level of the hinder end of the pharynx, there is a slight dilatation containing spermatozoa.

The vesicula (*pr.*) lying above the penis is small. Its wall

consists of a very thin layer of circular muscle-fibres, lined with a cubical epithelium, the nuclei of the cells of which lie close to the lumen, and which has rather the appearance of an exhausted secretory tissue. This organ I call the prostate (Pl. XXIII. fig. 4, *pro.*). About halfway between the penis and female aperture lies an organ which bears some resemblance to the penis already described. This organ constitutes one of the most interesting features of this anomalous species. It consists of a small protrusible penis-like organ (*p.*?), about one-third the size of that first described, lying in a small antrum. It is pierced by a short duct, which runs into it from a small non-muscular vesicle which lies immediately above it (*pr.*?). This small vesicle is of about the same size as the prostate. There is no communication, so far as I can discover, between the duct connecting these structures and the vasa deferentia (Pl. XXIII. fig. 5).

Text-fig. 54.



Genital apparatus of *Bergendalia anomala*.

acc., accessory part of vagina; *p.*?, penis-like organ; *pr.*?, prostate-like organ; *s.*, spiral coils of vagina. For other letters, see p. 318.

I can suggest only two explanations of the presence of this second penis-like organ and its accessories.

Firstly, that it may be regarded as a prostatic structure which has lost its connection with the penis and developed an intromittent terminal part of its own. Such a state of affairs is found in the Cotylean family Diposthiidæ; but in that case both penis and prostate open into a common antrum, and there is what appears to be a prostate gland in connection with the penis in *Bergendalia*, a fact which makes strongly against this view.

The second possible explanation is that the organs under discussion are the vestiges of a second penis. The fact that they bear a close resemblance to the functional penis tends to support this view, as does also, I think, a comparison with *Cryptocelides* of Bergendal [1].

This is the only other Polyclad described, so far as I know, in which two penial organs lie behind each other on the middle line; but, according to Bergendal, they lie behind the female aperture, and, further, both open into a common antrum, whilst in some cases

there may be four or even six penes present. In another genus presumably allied to this, viz. *Polypostia* Bergendal [1], the penes lie in large numbers around the female aperture.

The female apparatus is no less remarkable than that of the male. The vagina (*va.*) runs forward for some little distance from the aperture, then turns upwards. As it does so, it is twisted into a remarkable spiral coil, making some five complete turns. It then runs backwards, narrows considerably, and soon receives the openings of the two uteri (*ut.*) on its ventral side. Beyond this point it is continued back as a narrow accessory vesicle (*acc.ves.*) about as far as the level of the female aperture, when it turns sharply ventralwards and *opens to the exterior by the antrum.*

The only other Polyclads with which I am acquainted that possess a secondary female opening are *Trigonoporus* of Lang [6] and *Polyporus* of von Plehn [11], but in both these cases the second opening is quite distinct from the primary one (the true antrum femininum).

The curious spiral twisting of the vagina in the present species is, so far as I know, unparalleled in the order.

For the first part of its course, *i. e.* whilst it is running forwards, the vagina is lined with elongated columnar ciliated cells, the nuclei of which lie near their bases. Outside this epithelium is a thin layer of circular muscle-fibres, and beyond these, in my sections, can be seen a great number of nuclei massed round the vagina, and probably belonging to gland-cells. Where the vagina turns dorsalwards and becomes spirally twisted it has narrowed slightly, but its epithelium retains the characters already mentioned. The muscle-sheath does not follow the individual folds of the spiral, but forms a continuous covering for that part of the duct (Pl. XXIII. fig. 6, *m.s.*). The rest of the terminal female ducts are precisely similar in character to the first part of the vagina, only narrower. There seem to be no special shell-glands present.

The genus may be defined as an *Acotylean genus in which behind the functional penis a small second penial organ occurs. The accessory vesicle of the female apparatus opens to the exterior through the antrum femininum. Body pointed at either end. Marginal eye-spots present; mouth subcentral.*

Family Latocestidæ.

Latocestus argus, sp. n.

Four specimens were collected by Mr. Evans. One of these is labelled "Chocolate-brown above, slightly lighter below."

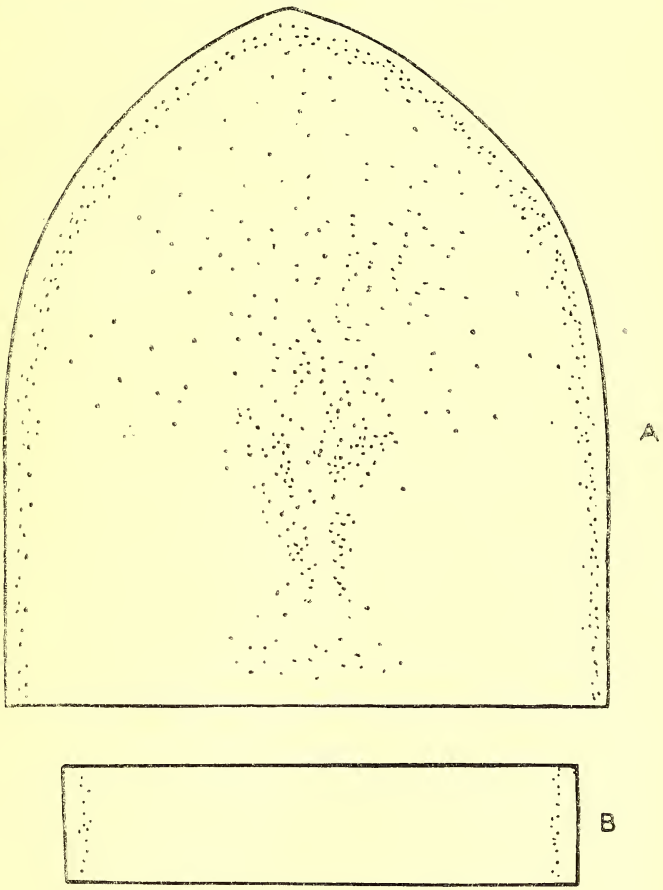
The largest specimen has a total length of about 30 mm. and a breadth of 5 mm. The mouth is 2·5 mm. from the hinder end of the body.

This species is proportionately longer than the other member of the genus which I have had an opportunity of examining. Its most striking feature is the presence of a crowded row of eye-spots running completely round the margin of the body. The

arrangement of the eyes at the anterior end of the body is shown in text-fig. 55 A and towards the hinder end in 55 B.

The only other elongate form exhibiting this character with which I am acquainted is *Cestoplana ? maldivensis* mihi. This is almost certainly a *Latocestus*.

Text-fig. 55.



Eye-spots of *Latocestus argus*.

I can detect no rhabdites in the epidermis. The parenchyma is very dense, and nervous tissue abundant on the ventral side just within the body-wall muscles.

The terminal parts of the reproductive apparatus are almost exactly similar to those figured by von Plehn [7] for *Latocestus pacificus*.

As in that species, the testes as well as the ovaries lie on the dorsal side of the body.

THYSANOZOON AUROPUNCTATUM Coll.

Thysanozoon auropunctatum Lang [6]; von Stummer-Traunfels [13].

One specimen, unfortunately immature and in a poor state of preservation, although it has retained its colour fairly well.

PSEUDOCEROS BEDFORDI, sp. n. (Plate XXIII. fig. 9.)

This strikingly handsome and large species was obtained by Messrs. Lanchester and Bedford in Singapore Harbour. The single specimen, kindly given me by Mr. Lanchester, was unfortunately in fragments and fully one-half of the specimen missing, so that a satisfactory examination was not possible. I believe, however, that it was provided with a pair of penes. The colouring is very beautiful, and quite sufficiently marked to render the identification of this species in the future a simple matter, thanks to the careful drawing for which I am indebted to Miss Dust.

On the label accompanying the specimen is written "Singapore Harbour, from tide-marks to 10 faths." I venture to associate with this species the name of my lamented friend the late Mr. Bedford.

PSEUDOCEROS COLLINGWOODI, sp. n.

Closely allied to *Ps. cerebralis* (Kelaart) and *Ps. striatus* (Kelaart), but smaller than either. It has the same regular convolutions at the margin of the body that are shown in Collingwood's figures, and the coloration is similar especially to *Ps. cerebralis*.

Length, about.....	30	mm.	
Breadth „	25	„	
Mouth-opening, about	3	„	from the anterior margin.
Sucker about	8	„	behind the mouth.

The specimen is immature and the penis is unpaired. Colour—dorsal surface mottled dark brown and brownish white. The extreme margin is white, but the white rim is exceedingly thin; just inside this is an equally fine black line. Ventral surface pale brownish white, becoming darker towards the margin, which is edged with black and white just as on the dorsal surface.

PSEUDOCEROS? RUBELLUS, sp. n. (Plate XXIII. fig. 10.)

A number of specimens of this very small species were collected. One of these was "found under a stone between tide-marks. It was magenta-red in colour. Nov. 1899." Though very small, these specimens appear for the most part to be mature. They bear a close resemblance to *Pseudoceros kelaartii* (Coll.) in colour, but the latter species is much larger and has the eye-spots arranged quite differently. The arrangement in the present species is shown

in fig. 10 of Plate XXIII. The tentacles also in Collingwood's species are much more prominent. The penis is unpaired. The body is nearly circular and the sucker median. Total length about 5 mm., breadth 4 mm. The arrangement of the eye-spots is very different from that normally found in *Pseudoceros*, but I cannot find any other characters distinguishing it from that genus.

At least two other species of this genus are represented in the collection. One of these is a very small individual of the *P. superbus*-group (perhaps *P. hancockianus*); whilst several specimens belong to a species coloured exactly as *Proceros concinnum* Coll., viz., they are blue, with orange margin and median stripe. They are, however, very much smaller, about 8 mm. to 10 mm. in length, and of a different shape, not pointed at their hinder end, and have small, folded tentacles, whereas Collingwood's species has pointed tentacles. *Proceros concinnum* in fact is almost certainly a Euryleptid, whilst these specimens are undoubtedly members of the genus *Pseudoceros*.

I prefer, however, not to name them at present.

Family Diposthidæ.

Asthenoceros, gen. nov.

Asthenoceros woodworthi, sp. n. (Plate XXIII. fig. 7.)

Two specimens, without notes as to colour; but, to judge from these spirit-specimens, the species is of a reddish-brown colour, darkest on the middle line.

Length, about ...	17 mm.	
Breadth.....	14 „	
Mouth-opening...	7 „	from the anterior margin.
Sucker	1·5 „	behind mouth.

The male and female apertures lie in the usual order between the "mouth" and sucker.

The pharynx is large and much folded, its opening being submedian. This feature will serve at a glance to distinguish this species from any of the Pseudoceridæ. In describing the type of the family, Woodworth [16] makes no statement as to the pharynx, but, to judge from the figure given, it is median or submedian as in the present species.

The body is flat and almost circular; the anterior margin is feebly folded, and there is a small group of eye-spots on either side of the middle line, but there are no very definite tentacles. The prostate body lies *in front of the penis*.

In this respect *Asthenoceros* differs from the type-genus *Diposthus*. There are no brain-eyes.

Only one of the two specimens was cut into sections, transversely; the other specimen appears, from an examination of it when cleared in oil of cloves, to be quite immature. The specimen serially cut presents certain peculiar features, which I am at

a loss to explain satisfactorily. In the first place, the testes and ovaries are very immature, and apparently only the terminal parts of the genital ducts are developed. On the other hand, there is, immediately over the penis, a large mass of mature spermatozoa lying in a chamber the character of which cannot be determined from my specimens, since it appears in places to have indications of a proper lining-epithelium of its own, and again in places seems to be merely a gap in the parenchymatous tissue. There are very faint indications of a duct running from this chamber down in the direction of the penis, but this duct cannot be traced far. Woodworth [16] suggests in connection with the specimens of *Diposthus* described by him, that they were in a late stage of sexual activity, and that in consequence of this the sexual organs were in a reduced condition. Possibly in my specimens of *Asthenoceros* a similar state of affairs occurs, but, as I have already stated, testes and ovaries in a very immature state are present. There is also a possibility that the ripe spermatozoa may be derived from another individual by hypodermic injection; but I do not think this is the case—firstly, because the penis is not armed with a stylet; and, secondly, because the spermatozoa lie over the penis, and because, as already stated, there are traces of a duct running towards the penis from the chamber in which they lie.

The terminal parts of the male apparatus histologically resemble those of *Diposthus*. The prostate and penis are separated into two distinct organs, "both of which are doubtless intromittent," both opening by a single gonopore. The prostate lies immediately in front, the penis directly over the aperture. It is rather feebly supplied with muscle-fibres, and the secretory cells lie in the middle of the organ, but there is no lumen apparent (cf. *Diposthus corallicola*).

The penis is much more muscular, and on the outer side has a very definite series of circular and longitudinal fibres. Nuclei in it too are much more numerous (Pl. XXIII. fig. 7).

In connection with the female organs there are traces of two pairs of uterine vesicles. The uteri are very small and difficult to distinguish from the surrounding tissue, and the ducts running to them are merely solid rods of cells of an embryonic appearance. The uteri open into the hinder end of the vagina. The antrum is deep, and widens at its upper end where it receives the secretion of the shell-glands.

The body epithelium is very densely crowded with small rhabdites, and on the dorsal side especially with pseudorhabdites. Scattered through the parenchyma, more particularly in the region of the sucker, are numbers of small rounded darkly-staining cells the nature of which is doubtful. The ventral surface of the body projects immediately behind the pharynx into a prominent median ridge which carries the gonopores and the sucker; behind the sucker the ridge disappears.

I have given as complete an account as possible of the cha-

racters of the genital organs, but, owing to the condition of the specimen, it is obviously far from being satisfactory, and in order to deal fully with this interesting species more material is necessary.

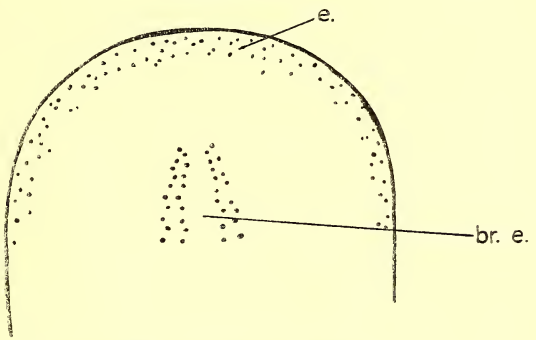
PROSTHIOSTOMUM PALLIDUM, sp. n.

One specimen, from the sea-shore, Dec. 1899.

Total length, about	20 mm.
Breadth, about	4 „

Anterior margin rounded. Arrangement of eye-spots shown in text-fig. 56.

Text-fig. 56.



Eye-spots of *Prosthiostomum pallidum*.
e, marginal; *br.e*, brain eye-spots.

Closely allied to *P. siphunculus* of the Mediterranean by the arrangement of the eye-spots, and agreeing with it apparently in being, so far as the spirit-specimen shows, of an uninterrupted dull grey-brown colour, it differs sufficiently in that the two rows of brain-eyes diverge continuously from one another from before backwards, whilst in the Mediterranean species these two rows converge at their middle.

It is also readily distinguishable, I think, from the latter species by its smaller size. The single specimen obtained by Mr. Evans is, to judge from the state of the sexual apparatus, fully mature. *P. siphunculus*, moreover, has the genital sexual organs relatively much smaller, to judge from Lang's figures (see Lang, 'Polycladida,' pl. 5. fig. 3).

P. pallidum is certainly very distinct from any species from the Indian Ocean that I have had the opportunity of studying, and also, I believe, from the species found in the Pacific.

I believe that *Leptoplana aurantiaca* of Collingwood is really a *Prosthiostomum*. It has the shape and proportions of a member of that genus, whilst its eye-spots have the characteristic *Prosthiostomum* arrangement. It may, of course, be identical with the

species described above, but, judging from Collingwood's figure, in the arrangement of the eye-spots it is sufficiently distinct.

Literature.

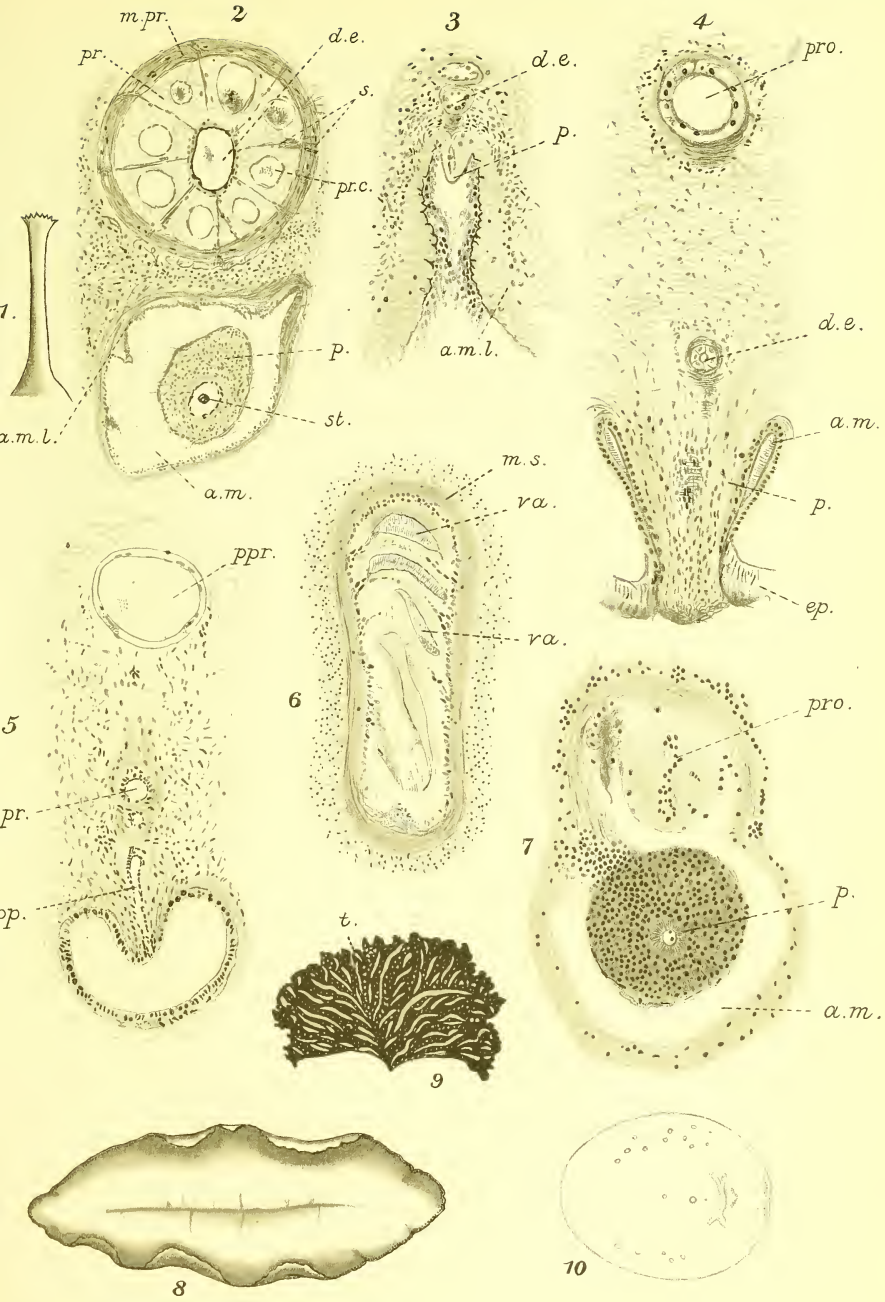
1. Bergendal. "Kongl. Fysiogr. Sallskapet," Lund Handlingar, Ny Följd, 1892–93, Bd. 4.
2. Collingwood. Trans. Linn. Soc. Lond. ser. 2, Zool. i. 1875, p. 83, pls. 17–19.
3. Graff, von. Zeitschr. wiss. Zool. lv. 1893, p. 189.
4. Laidlaw. Fauna and Flora of the Maldives and Laccadives, i. p. 282, pls. xiv., xv.
5. —— Mem. & Proc. Lit. & Phil. Soc. Manchester, xlvii. p. 1 (1903).
6. Lang. Naples Monogr. xi., 1884.
7. Plehn, von. Jena. Zeitschr. xxx. p. 137, t. viii. & xiii.
8. —— Ergebn. Plankt.-Exp., Heft i., 1896.
9. —— Semon's Zoologische Forschungsreisen, Bd. v. pp. 329–334, t. xxiii.
10. —— Abh. Senckenb. Gesell. xxiv. ii. pp. 145–146 (1897).
11. —— Jena. Zeitschr. xxxi. p. 90, t. v. (1898).
12. —— Zool. Jahrb. Syst. xii. pp. 448–452 (1899).
13. Stummer-Traunfels, von. Zeitschr. wiss. Zool. lx. p. 688, t. xxxv.–xxxviii.
14. Verrill. Trans. Connect. Acad. viii. p. 459, pl. xliv.
15. —— ,, ,, ix. p. 523.
16. Woodworth. Bull. Mus. Comp. Anat. xxxii. 4, pp. 63–67, pl. i. (1897).

EXPLANATION OF PLATE XXIII.

Fig. 1. Spine from the lumen of the penis of *Planocera* sp., p. 302.
2. Section passing through the penis and prostate organ of *Notoplana evansii*, p. 302.
3. Transverse section through the penis of *Leptoplana malayana*, p. 306.
4. Transverse section through the penis and prostate gland (?) of *Bergendalia anomala*, p. 310.
5. Section through the rudimentary organ of penis-like structure of the same species, p. 311.
6. Section through the spiral part of the vagina of the same, p. 312.
7. Section across the antrum masculinum of *Asthenoceros woodworthi*, p. 315. These organs are directed obliquely forward, and consequently both appear in some of the sections. The granular appearance of the prostate in this region is rather exaggerated in the figure, but it becomes more marked towards its extremity.
8. *Bergendalia anomala*, p. 306.
9. *Pseudoceros bedfordi*, fragment of anterior part of body, p. 314.
10. *Pseudoceros ? rubellus*, p. 314.

Explanation of Lettering of Plate and Text-figures.

a.m., antrum masculinum.
a.m.l., muscular walls of antrum masculinum.
d.e., ductus ejaculatorius.
d.pr., prostate duct.
ep., epidermis.
m.pr., muscular walls of prostate.
m.v., muscular sheath of vagina.
p., penis.
pp., vestigial penis ?
pr., prostatic cells.
pr.c., chamber of the prostate.
pro., prostate.
ppr., prostate-like organ.
s., septum between chamber of prostate.
st., stylet of penis.
t., tentacles.
va., lumen of vagina.
v.d., vasa deferentia.
v.s., vesicula seminalis.



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POLYCLADS FROM THE STRAITS OF MALACCA.